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UNITED STATES DEPARTMENT OF AGRICULTURE

# BULLETIN No. 596

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A. D. MELVIN, Chief

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# FEEDING DRIED PRESSED POTATOES TO SWINE.

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## DRIED PRESSED POTATO.

Two investigators in the United States Department of Agriculture, William Stuart, of the Bureau of Plant Industry, and H. C. Gore, of the Bureau of Chemistry, have been studying the potato situation in the United States for the purpose of determining a suitable way to dispose of surplus potatoes. The dried pressed potato used in the feeding experiments was manufactured at the Government Experimental Farm, Arlington, Va. The following analysis of the feed shows that it is rich in carbohydrates, mostly starch, and poor in fat, protein, and ash ingredients.

*Chemical analysis of dried pressed potato used in experimental work.*

| Moisture. | Ash. | Ether extract. | Protein. | Crude fiber. | Nitrogen-free extract. |
|---|---|---|---|---|---|
| *Per cent.* 11.97 | *Per cent.* 0.89 | *Per cent.* 2.10 | *Per cent.* 2.19 | *Per cent.* 1.97 | *Per cent.* 80.88 |

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## THE FEEDING EXPERIMENT.

The Animal Husbandry Division having been requested to cooperate in determining the value of dried pressed potato as a feed for swine, decided, after careful consideration as to the probable importance of the work, to carry on an extended feeding test at its farm at Beltsville. Five tons of dried pressed potato, manufactured at the Arlington farm, were shipped to the Beltsville farm for this purpose.

The experiment was conducted to determine (1) the value of dried pressed potato in a ration for fattening hogs when supplemented by feeds rich in protein, (2) the effect of dried pressed potato on the quality of meat produced.

### METHODS AND RATIONS.

The experimental feeding was started September 12, 1916, and continued 56 days, ending November 7, 1916. The animals selected for the work were 12 high-grade Berkshire pigs between 5 and 6 months of age, averaging approximately 150 pounds in weight, and quite uniform in age, quality, breeding, and weight. (See fig. 1.) The pigs were taken off pasture and put in the dry lot a week before the experiment began. They were confined in a permanent hog house and arranged into pens of three pigs each. These pens had cork-brick floors and measured 6 feet by 7½ feet. Attached thereto were outside runs made of concrete and measuring 7 feet by 39 feet. Prior to the experiment the ration fed to these pigs consisted of 5 parts corn

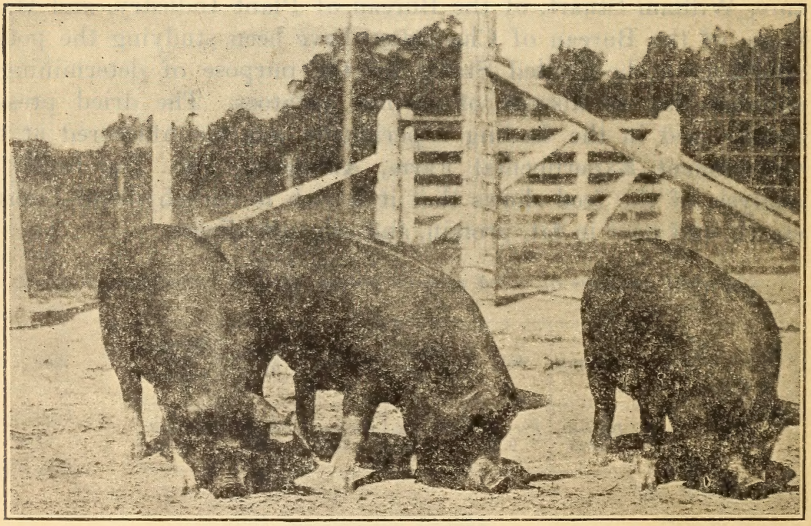


FIG. 1.—Type of hogs used in experimental feeding.

meal, 4 parts middlings, and 1 part tankage. The lots and rations for the experimental feeding were as follows:

Lot I (check lot).—6 parts corn meal, 1 part tankage.

Lot II.—6 parts dried pressed potato, 1 part tankage.

Lot III.—6 parts dried pressed potato, 1 part linseed-oil meal (old process).

Lot IV.—6 parts dried pressed potato, 1 part fish meal.[1]

The lots were fed three times daily (7 a. m., 11.30 a. m., and 4.30 p. m.). For each meal the feed for each lot was weighed and put into a bucket with a sufficient amount of water to make a thick slop, this being done about half an hour before feeding, so as to allow time to soak. Raw steam was turned into each bucket of feed for a few minutes just after the feed was mixed to facilitate the soaking. A fresh supply of water was given to the pigs about the middle of the forenoon. The animals were weighed on the scales located inside the permanent hog house. Individual weights were taken for three consecutive days (one day previous to the beginning of the experiment and each of the first two days of the experiment). The average of the three weights was taken as the weight of the second day, or the beginning of the experiment. The final division into lots followed the first weighing, which was on the day previous to the beginning of the experiment proper. Individual weights were taken every Tuesday thereafter until the conclusion of the experiment.

### COMPOSITION OF RATIONS.

Following are the analyses of the dried pressed potato rations as made by the Bureau of Chemistry, United States Department of Agriculture:

*Chemical composition of dried potato rations.*

| Ration. | Moisture. | Ash. | Ether extract. | Protein. | Crude fiber. | Nitrogen-free extract. |
|---|---|---|---|---|---|---|
| | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| Dried pressed potato and tankage | 11.83 | 3.04 | 0.80 | 11.03 | 2.29 | 71.01 |
| Dried pressed potato and oil meal | 11.91 | 1.65 | .67 | 5.96 | 2.98 | 76.83 |
| Dried pressed potato and fish meal | 10.96 | 4.04 | 2.87 | 13.09 | 1.85 | 67.19 |

### RESULTS OF THE FEEDING.

The pigs in all of the lots ate well and regularly, and not one went off feed during the test. Small quantities of feed were left in the troughs after feeding time, but this was due to the fact that the pigs

[1] Fish meal is a very effective supplement to a grain ration for pigs. They are extremely fond of it and make rapid and economical gains on such a ration. Those who wish to obtain further information on the subject of feeding fish meal to live stock may consult United States Department of Agriculture Bulletins 378, "Fish Meal, Its Use as a Stock and Poultry Feed," and 610, "Fish Meal as a Feed for Swine," which may be had from the Superintendent of Documents, Washington, D. C., at the price of 5 cents each.

were given a little more than they could conveniently consume. Dried pressed potato is rather bulky, and it is difficult to judge exactly the right amount that will be cleaned up by the pigs at one feed. At the beginning of the test the amount fed was 2 pounds per head per day. This, of course, was a very small amount of feed for 150-pound pigs, but they were given this small portion because this method of gradually starting them on a feed tends to keep the appetite keen, and the chances of going off feed are very much lessened. It also gives the pigs a better chance to cultivate an appetite for a new feed. One fact is evident from the figures given in the next table, namely, that the dried pressed potato rations were palatable and eaten readily by the pigs, since all those in the potato lots consumed an average daily ration of 5½ pounds.

TABLE I.—*Results of feeding 4 lots of 3 pigs on various feeds during fattening period, Sept. 12, to Nov. 7, 1916 (56 days).*

| Data. | Lot I (check). | Lot II. | Lot III. | Lot IV. |
|---|---|---|---|---|
| | Fed 6 parts corn meal, 1 part tankage. | Fed 6 parts dried pressed potato, 1 part tankage. | Fed 6 parts dried pressed potato, 1 part oil meal. | Fed 6 parts dried pressed potato, 1 part fish meal. |
| | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* |
| Average initial weight | 153.33 | 153.33 | 150.00 | 154.33 |
| Average final weight | 242 | 198.33 | 206.33 | 228.66 |
| Average gain per pig | 87.77 | 45.00 | 51.33 | 74.33 |
| Average daily gain | 1.57 | .80 | .91 | 1.32 |
| Total feed | 1,072 | 939 | 900.5 | 956.5 |
| Pounds fed per 100 pounds gain | 403 | 695 | 584 | 428 |
| Daily feed per 100 pounds live weight | 3.23 | 3.16 | 2.93 | 2.91 |
| Average daily feed | 6.4 | 5.5 | 5.3 | 5.7 |

All the pigs were in good, thrifty, and growing condition when the experiment began, and they maintained good condition and health during the progress of the test. A study of the table will show that lot 1 (check) excels all the others with respect to rate of gains, amount of feed consumed to produce 100 pounds of gain, and the average final weight. This lot of pigs was the largest and growthiest of any of the lots in the experiment. They were heavy feeders and returned good gains for the amount of feed consumed. These pigs consumed a daily ration of 6.4 pounds, made a daily gain of 1.57 pounds, and required 403 pounds of feed to produce 100 pounds of gain.

The lot receiving dried pressed potato and fish meal (Lot IV) was a very close second to the check lot. The figures, of course, show greater advantages in favor of the check lot than were apparent to the eye. Both these lots maintained tiptop condition throughout the experiment and carried a very high degree of finish. There was

13 pounds difference in favor of the hogs in the check lot at the close of the test. The pigs in Lot IV were evidently as heavy feeders as those in the check lot, but it is impossible for pigs to consume very large amounts of the dried pressed potato on account of the bulkiness of the feeds. The pigs in Lot IV consumed a daily ration of 5.7 pounds, made a daily gain of 1.32 pounds, and required 428 pounds of feed to produce 100 pounds of gain.

The pigs in Lot III, receiving dried pressed potato and oil meal, consumed less feed than any other lot in the experiment. It might be concluded from this that the ration was the least palatable and least efficient of any of the rations fed. This, however, is not true, because the pigs in Lot II, receiving dried pressed potato and tankage, ate more feed than the pigs receiving dried pressed potato and oil meal, but made smaller gains. This tends to prove that the potato ration containing oil meal is more efficient in producing gains than the potato ration containing tankage, although the pigs ate less of the potato and oil-meal feed. Furthermore, the pigs in Lot III possessed a higher degree of finish than the potato and tankage pigs (Lot II), although they were not equal to the potato and fish-meal pigs (Lot IV) in this respect. The pigs in Lot III consumed a daily ration of 5.3 pounds, made a daily gain of 0.91 pound, and required 584 pounds of feed to produce 100 pounds of gain.

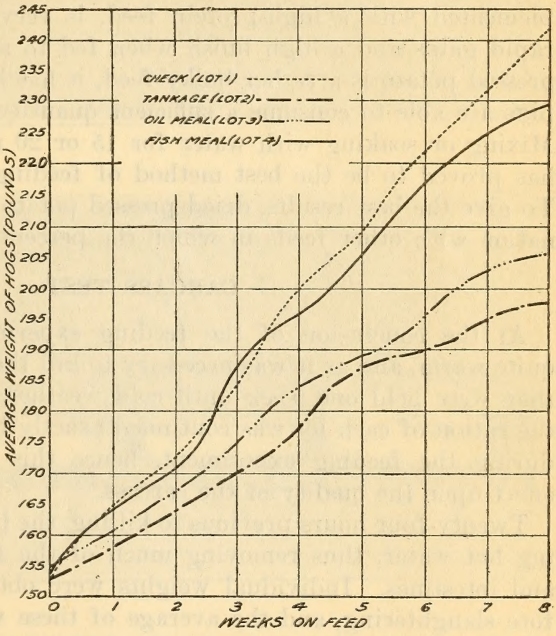



FIG. 2.—Average progressive weekly gains of each lot during feeding experiment.

The pigs in Lot II, which were fed dried pressed potato and tankage, consumed enough feed to put them in higher condition than they were in at the close of the feeding test. The showing that these pigs made can not be called poor, but it is evident that tankage is not as efficient a protein supplement to use with dried pressed potato as some of the other supplements used in this experiment. The pigs in Lot II returned a smaller amount of gain for the

amount of feed consumed than any other lot. They consumed an average daily ration of 5.5 pounds, made an average daily gain of 0.8 pound, and required 695 pounds of feed to put on 100 pounds of gain.

Figure 2 shows graphically the weekly gains of each of the lots during the experimental feeding.

### SUMMARY OF FEEDING EXPERIMENT.

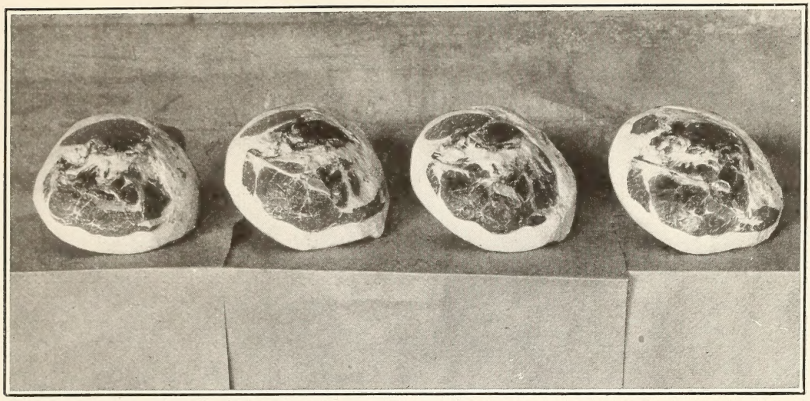
Judging from the results obtained from the feeding experiment, we are justified in concluding that dried pressed potato, when supplemented with a high-protein feed, is very efficient in producing rapid gains and a high finish when fed to swine. Although dried pressed potato is a rather bulky feed, it has been demonstrated that pigs are able to consume a sufficient quantity to lay on good gains. Mixing or soaking with water for 15 or 20 minutes before feeding has proved to be the best method of feeding dried pressed potato. To give the best results, dried pressed potato must be fed in combination with other feeds in which the percentage of protein is high.

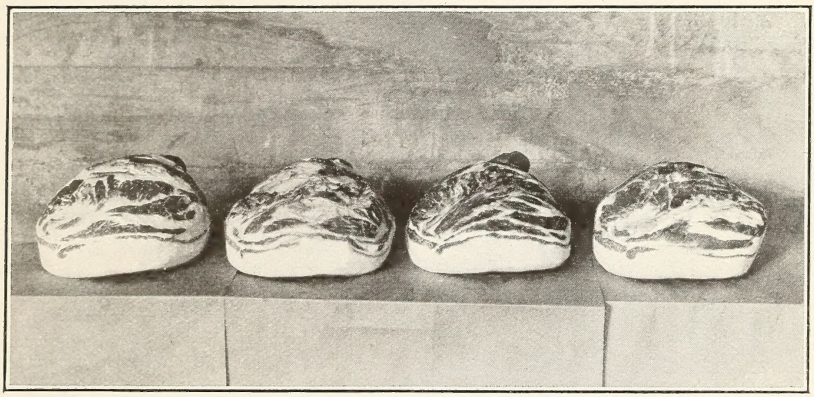
## CARCASS TEST.

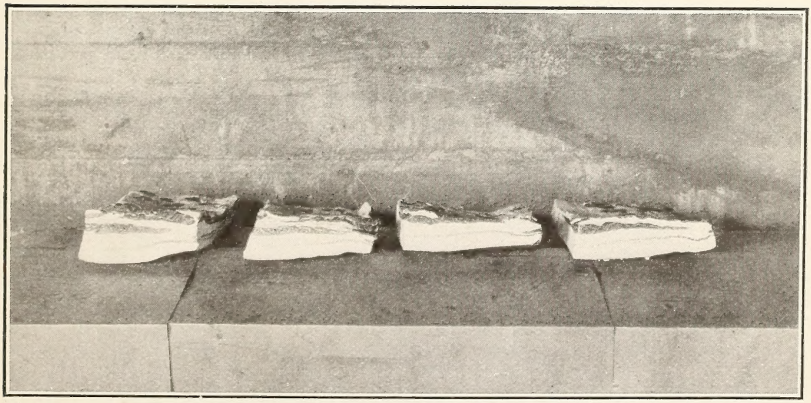
At the conclusion of the feeding experiment the weather was quite warm, and as it was necessary to kill the hogs "country style," they were held one week until cold weather. During this interval the ration of each lot was continued exactly the same as it had been during the feeding experiment, hence this delay would have no effect upon the quality of the carcass.

Twenty-four hours previous to killing, the hogs had access to nothing but water, thus removing much of the feed from the stomach and intestines. Individual weights were obtained immediately before slaughtering, and the average of these weights for each lot is recorded in the table below as the "Weight at killing time." The other data in the table were ascertained as soon as possible after slaughtering, the work being done as rapidly as was consistent with accuracy in order to minimize loss in weight through drying. The firmness of the flesh and fat was noted at this time, and again next morning after the carcass had cooled overnight at a freezing temperature.

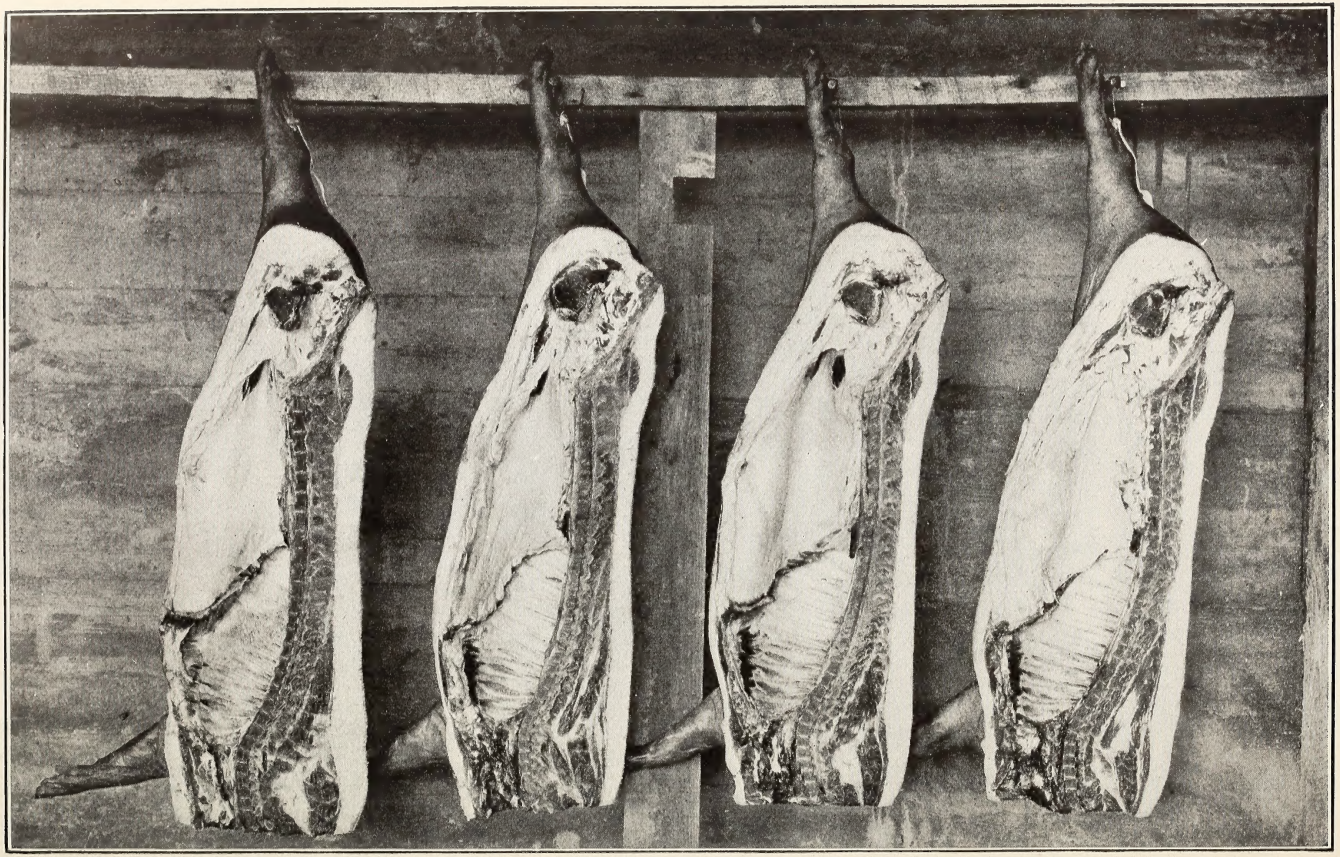
Four hogs, the heaviest from each of the four lots, were reserved for the carcass demonstration to determine the quality of the flesh and fat, and if possible the degree of finish in each one. The carcasses were divided into the regular meat cuts in as nearly a uniform manner as was possible. The fresh pork from each hog was eaten by individuals who were ignorant of the feed that the hog had received, in order to test the flavor and cooking qualities of the meat. The lard was cut from the trimmings and rendered, as was also that







HAMS, SHOULDERS, AND SIDE BACON FROM HEAVIEST HOG IN LOTS I, II, III, AND IV, READING FROM LEFT TO RIGHT IN EACH CASE.



HALF CARCASSES OF HEAVIEST HOG IN LOTS I, II, III, AND IV, READING FROM LEFT TO RIGHT.

from the leaf, and observations made upon them. The data collected from the rendering of the lard are shown in Table III, which also gives some indication of the degree of finish obtained through these different feeds.

TABLE II.—*Slaughter data. Average of hogs in each lot.*

| | Lot I. | Lot II. | Lot III. | Lot IV. |
|---|---|---|---|---|
| | Fed 6 parts corn meal, 1 part tankage. | Fed 6 parts dried pressed potato, 1 part tankage. | Fed 6 parts dried pressed potato, 1 part oil meal. | Fed 6 parts dried pressed potato, 1 part fish meal. |
| | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* |
| Weight at killing time | 230 | 190 | 200 | 214 |
| Weight after bleeding and scraping | 219 | 181 | 189 | 204 |
| Weight of carcass | 186 | 148 | 156 | 172 |
| Weight of leaf lard | 6.69 | 5.06 | 5 | 5.12 |
| Weight of intestines and paunch | 16.44 | 18.81 | 20.19 | 17.56 |
| Weight of omentum | .81 | .62 | .62 | .69 |
| Weight of spleen | .31 | .25 | .31 | .44 |
| Weight of pluck | 8 | 6 | 6.87 | 7.12 |
| Dressing.....per cent | 80.9 | 78.0 | 78.0 | 80.4 |

It will be noted that the hogs fed corn meal (Lot I) showed the highest dressing percentage, with the dried pressed potato and fish meal (Lot IV) a very close second. The other two dried pressed potato lots had relatively low dressing percentages. This difference is largely explained by examining the weights of the intestines and paunch, in which the check lot (Lot I), although the largest hogs, had the lightest weight. Only 7.1 per cent of the live weight of the check hogs was contained in the digestive tract, while 9.3 per cent of the live weight of all the hogs fed on dried pressed potatoes was found here. These figures would seem to indicate that a ration consisting chiefly of dried pressed potato meal causes a large development of the digestive tract, due no doubt to the bulky nature of the feed.

In judging the firmness of the flesh and fat we used no instruments of precision, simply the eye and the sense of touch. In the freshly killed condition it was very easy to see that the fat in Lots II and IV was not as solid as that in the check lot (Lot I), and the feel of these three lots bore out their appearance. In Lot III, however, fed on dried pressed potato and oil meal, the fat was of a little firmer texture than in the other two lots fed on the potato feed, although it hardly seemed of the same consistency as Lot I. As to the quality of the flesh, we could note no difference. Upon cooling out thoroughly it was much more difficult to note any difference in the firmness of the fat.

On the whole it is impossible to say that dried pressed potato meal does not produce a fat equal for all purposes to that produced by

corn meal. While we were able to note some little difference in hardness in favor of the lot fed on corn meal, that difference was so small as not to be noticed under average packing-house conditions. Dried pressed potato meal does not produce soft pork.

### QUALITY OF THE MEAT.

The four carcasses, one from each lot, which were reserved for the butchering test were found to be very similar in the development of the several parts. More variation was discovered among the three potato-fed hogs than there was between them as a group and the check hog. The fresh pork, principally the chops, was cooked and eaten by disinterested parties, as well as by the experimenters, and no difference in flavor or quality could be detected. In judging the degree of finish, the various cuts were examined as shown in Plate I. Excepting in the case of the bacon strips, little difference can be detected. Here it is indicated that the corn-fed hog is much the fattest.

An examination of half the carcass, observing chiefly the thickness of fat on the back, indicates that the hog from Lot I, the check lot, had much the heaviest covering in this region. It must be remembered, however, that the other three carcasses were not as large and that, relatively speaking, the covering shown on the hog from Lot III is almost as heavy (see Pl. II).

### LARD.

In order to judge more accurately the degree of finish, the lard was separated as previously noted and rendered under as nearly uniform conditions as possible. The results are given in the following table:

TABLE III.—*Lard data from largest hog in each lot.*

| Data. | Lot I. Fed 6 parts corn meal, 1 part tankage. | | Lot II. Fed 6 parts dried pressed potato, 1 part tankage. | | Lot III. Fed 6 parts dried pressed potato, 1 part oil meal. | | Lot IV. Fed 6 parts dried pressed potato, 1 part fish meal. | |
|---|---|---|---|---|---|---|---|---|
| | Leaf lard. | Fat lard. | Leaf lard. | Fat lard. | Leaf lard. | Fat lard. | Leaf lard. | Fat lard. |
| Weight of cut lard.....pounds.. | 6.75 | 16.25 | 5.37 | 13 | 5 | 15.12 | 5.12 | 15.87 |
| Weight of rendered lard.....do.... | 6.31 | 14.25 | 5 | 11.50 | 4.69 | 13.62 | 4.62 | 13.75 |
| Per cent of rendered lard..... | 93.5 | 87.7 | 93 | 88.4 | 93.7 | 90 | 90.2 | 86.6 |
| Weight of carcass.....pounds.. | 193 | | 160 | | 163 | | 174 | |
| Per cent of rendered lard to carcass... | 10.65 | | 10.31 | | 11.23 | | 10.56 | |

This table bears out the previous indications that the hog fed on corn meal had the largest amount of fat, but it also shows that one hog fed dried pressed potato meal and linseed-oil meal produced

relatively more fat in proportion to carcass. This was due to the fact that the latter hog was a little fatter and that the fat rendered out a higher percentage of lard. This last fact would also indicate a higher degree of finish, for as the lard contained a lower percentage of water the cells must have been more heavily engorged with fat. The hog fed on potato meal and fish meal was nearly as fat as the check hog. The carcass showing the poorest condition was that of the hog fed on potato meal and tankage, showing that this combination of feeds not only produced the smallest and most expensive gains, but that it also returned a carcass with the smallest proportion of fat. No difference in taste, odor, color, or consistency could be noticed in the rendered lard.

### CURED MEAT.

The hams, shoulders, and bacon sides from the heaviest hog in each lot, as pictured in Plate I, were cured and smoked. A mild brine cure was used according to the following formula: For each 100 pounds of meat 2 ounces saltpeter, 2 pounds brown sugar, and 7 pounds salt dissolved in enough water to cover the meat. The shoulders and bacon sides were removed at the end of five weeks and the hams after eight weeks of curing. The cured meat was allowed to drain 24 hours. After draining it was rubbed with pepper and smoked for six days with hickory wood. The results are shown in Tables IV and V.

TABLE IV.—*Weight variations in curing hams, shoulders, and side bacon.*

| Cut. | Lot No. | Green weight, Nov. 28. | Weight after curing, Jan. 23. | Weight after draining, Jan. 24. | Weight after smoking, Jan. 30. | Net gain (+) or loss (−) in weight. |
|---|---|---|---|---|---|---|
| | | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pound.* |
| Hams | Lot I | 17.00 | 18.12 | 17.94 | 16.75 | − 0.25 |
| | do | 13.81 | 15.00 | 14.81 | 13.69 | − .12 |
| | Lot II | 13.75 | 14.81 | 14.62 | 13.56 | − .19 |
| | do | 16.31 | 17.50 | 17.31 | 16.19 | − .12 |
| | Lot III | 13.87 | 14.56 | 14.44 | 13.50 | − .37 |
| | do | 14.50 | 15.50 | 15.25 | 14.37 | − .13 |
| | Lot IV | 16.75 | 17.69 | 17.50 | 16.50 | − .25 |
| | do | 15.81 | 16.50 | 16.37 | 15.25 | − .56 |
| Shoulders[1] | Lot I | 15.00 | 16.81 | 16.62 | 15.44 | + .44 |
| | do | 15.50 | 17.56 | 17.25 | 16.06 | + .56 |
| | Lot III | 13.44 | 14.94 | 14.75 | 13.62 | + .18 |
| | do | 12.62 | 14.25 | 13.94 | 12.87 | + .25 |
| | Lot IV | 13.69 | 15.50 | 15.25 | 14.06 | + .37 |
| | do | 14.56 | 16.25 | 16.00 | 14.87 | + .31 |
| Bacon sides | Lot I | 6.00 | 7.44 | 7.25 | 6.56 | + .56 |
| | do | 5.81 | 7.25 | 7.12 | 6.44 | + .63 |
| | Lot II | 4.50 | 5.94 | 5.69 | 5.00 | + .50 |
| | do | 3.62 | 4.62 | 4.37 | 3.87 | + .25 |
| | Lot III | 5.50 | 6.69 | 6.50 | 5.75 | + .25 |
| | do | 5.06 | 6.37 | 6.19 | 5.56 | + .50 |
| | Lot IV | 4.94 | 6.19 | 6.00 | 5.37 | + .43 |
| | do | 5.44 | 6.81 | 6.56 | 5.94 | + .50 |

[1] Owing to an accident the shoulders of Lot II were not cured.

TABLE V.—*Summary of curing and smoking.*

| Process. | Hams. | | Shoulders. | | Bacon sides. | |
|---|---|---|---|---|---|---|
| | *Pounds.* | *Per cent.* | *Pounds.* | *Per cent.* | *Pounds.* | *Per cent.* |
| Total green weight | 121.81 | 100.00 | 84.81 | 100.00 | 40.87 | 100.00 |
| Weight after curing | 129.69 | 106.05 | 95.31 | 112.38 | 51.31 | 125.53 |
| Weight after draining | 128.25 | 105.27 | 93.81 | 110.61 | 49.69 | 121.56 |
| Weight after smoking | 119.81 | 98.36 | 86.94 | 102.50 | 44.50 | 108.86 |
| Gain by curing | 6.44 | 5.27 | 9.00 | 10.61 | 8.82 | 21.56 |
| Loss by smoking | 8.44 | 6.91 | 6.87 | 8.11 | 5.19 | 12.70 |
| Net gain (+) or loss (−) | −2.00 | −1.64 | +2.13 | +2.50 | +3.63 | +8.86 |

It is seen from this table that there was no marked difference in the shrinkage of the cuts from the different lots. The large gains in weight in the shoulders and bacon sides were partly due to the fact that they remained in the brine for 8 weeks and absorbed more moisture than the hams.

The color of the smoked meat was very uniform, showing a rich brown on the outside. When cut the hams and shoulders had a rich color, not the shade of blood, but not in any way bleached out. The color was very uniform among the several lots.

Sample slices from all of the cuts from each hog were compared and no difference could be noticed in flavor, palatability, or cooking qualities. It was impossible to differentiate between the cured meat from the various lots; it was all excellent in quality, with an appetizing odor, and a delicate flavor.

### SUMMARY OF CARCASS DATA.

From a careful review of the foregoing the following conclusions are drawn:

Dried pressed potato meal fed with any of the three supplements used in the experimental feeding produced pork equal in quality to that produced by a ration of corn meal and tankage.

Dried pressed potato meal supplemented with old-process linseed-oil meal (Lot III) produced a carcass which for degree of finish excelled even that of the corn-meal hog (Lot I), and the degree of finish on the other two lots was but little inferior to that on the check hog (Lot I).

No difference could be noticed in any way in the curing qualities or in the excellence of the finished product raised from the hams, shoulders, and bacon sides of the hogs fed in the four different lots.

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